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AN ANALYTICAL STUDY ON EFFECT OF HEART RATE IN ARCHERY SHOOTING PERFORMANCE OF ANTHROPOMETRIC PROFILE OF SELECTED ARCHERS

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ABSTRACT

Archery necessitates a unique combination of strength and endurance for successful intermittent repeating shooting and performance, both in training and competition. It does not demonstrate extremely high demanding efforts in strength and endurance fitness areas when compared to other strength or endurance events, but it is very fitness demanding for accurate shooting in its own right. The study was done at the indoor archery hall by the Institutional Ethical Committee. Slow motion analysis was performed using Kinovea association's free motion analysis software (version 0.8.15; Paris, France), and time points frames were selected based on the arrow's release. The Kruskal-Wallis test and one-way ANOVA were performed. The goal of this study was to use a single variable to observe this complex relationship of adaptive training response. The coach's assessment of the heart rate deceleration pattern in the field has practical applications in performance enhancement. The pattern of heart rate values during the shooting process provides insight into the athlete's adaptive mechanism established over years of physical and psychological training.

KEYWORDS: Heart Rate, Shooting, Performance, Anthropometric, Profile, Archers.

INTRODUCTION

A combination of performance characteristics contribute to sports performance. Physical, physiological, psychological, anthropometrical, biochemical and other factors all contribute to a player's performance. Knowing what the most important performance criteria are will aid coaches and sports scientists in developing a better talent identification procedure for the game in question. Archery, on the other hand, necessitates a unique combination of strength and endurance for successful intermittent repeating shooting and performance, both in training and competition. It does not demonstrate extremely high demanding efforts in strength and endurance fitness areas when compared to other strength or endurance events, but it is very fitness demanding for accurate shooting in its own right. Several studies on archers have shown that repetitive shooting, particularly during competition, puts a significant amount of stress on the cardiovascular system. Despite the fact that there is a change in heart rate values prior to drawing, during drawing, and shooting, which is influenced by psychophysiological factors, there is also some muscular stress imposed on whole body musculature and chest and shoulder girdle muscles by posture, limited shooting time, and repetitive shooting. The event's analysis revealed that there is a necessity for cardiovascular fitness throughout lengthy hours of shooting and a high number of quality shots for effective training capacity, as well as during competition, which requires at least 150 shots spread out over a day.

- In certain archers, the effect of heart rate on shooting performance

A complete body tremor generated by the heart systolic cycle is a concern in shooting sports because hand-eye coordination is vital in shooting skills and performance. HR affects the duration of the systolic and diastolic phases of the heart cycle, with higher HR shortening the diastolic and lengthening the systolic phases. It was discovered that elite level shooters lower their heart rates right before shooting and trigger during the diastolic rather than systolic period. Archers' peak and average levels, like shooters, have been seen to drop their HR when shooting. In archery, like in pistol shooting, higher HR values are thought to have a low connection with scoring points, meaning that tremors caused by HR have a negative effect on aiming accuracy. Archers, on the other hand, have a greater HR during competition. As a level, there is a strong link between accurate shooting, high levels of performance, and HR. As a result, the goal of this study is to see how high HR values while shooting affect shooting performance in an indoor artificial competition environment among elite top level archers.

2. REVIEW OF THE LITERATURE

Adem Preljevi & Omer Pirtovi & Damir Ahmi & Lazar Toskic & Armin Zeirovi (2020) The primary goal of this study was to see how closely the system of factors used to assess specific motor abilities coincided with the system of variables used to assess effective football performance. A total of 170 senior football players were included in the investigation. There were 16 predictor variables for evaluating individual motor skills and eight criteria variables for determining success. The statistical approach used a canonical correlation analysis to discover the linkages (correlations) between these regions. With four pairs of canonical components, correlations were created between the researched spaces, and it was discovered that situational motor abilities have high correlations with performance success in the game of football (Can R.=0.71, on average). It was discovered that individuals with superior situational motor skills also had better football performance, and that the mechanism for organising movement is demonstrated to be extremely important for the successful performance of tactical and technical elements in football players.

Acikada, Caner & Hazr, Tahir & Asci, Alper & Hazr Aytar, Sinem & Tnazc, Cevdet (2019) The purpose of this study was to assess the effect of heart rate on shooting performance in elite archers,. Methods In an indoor area, 13 regularly trained international level elite archers (7 females, 6 males) conducted a (particular) regimen twice with a 3-day gap. The archers performed 4 sets of steady pace shuttle runs (males 10 km h1; females 8 km h1) for 3 minutes in a 20 m course, followed by a 1 minute stop during which they fired 3 shots at an 18 metre indoor target, and then a 1 minute rest during which blood was collected from the ear lobe for blood lactate (BL) analysis. For resting, running, shooting, and recovery times, heart rate monitors were utilised to record HR at 5-second intervals. The shots were scored in the same way that they would be in a regular indoor archery competition. For statistical analysis, the average (overall) findings were used. Results In the first and second tests, the mean HR and BL during resting shot were 119.0 and 112.2 bpm (range: 101–142 bpm, 2nd test: 96–135 bpm) and 1.72 and 1.65 mmol.L1 (range: 0.9–2.6 mmol.L1, 2nd test: 0.8–2.3 mmol.L1), respectively. In the first and second tests, the mean HR and BL during post-exercise shooting were 168 and 166 beats per minute (range: 152–191 beats per minute, 2nd test: 147–188 beats per minute) and 4.21 and 3.44 mmol.L1 (range: 1.3–7.0 mmol.L1, 2nd test: 1.3–5.7 mmol.L1), respectively. After jogging and resting, there was no statistically significant difference in shooting scores (27.50–27.23 points). High HR rates do not affect short distance shooting scores in a simulated indoor competition scenario, according to the findings.

Saidon Amri, Aris Ujang, Norjali Wazir, Mohd Rozilee Wazir, and Ahmad Naim Ismail (2012) The goal of this study was to look at the link between anthropometrics and motor performance, as well as to see what role combined anthropometric dimensions have in motor performance. This study included 225 male (n = 138) and female (n = 87) Malaysian university athletes aged 18 to 28 years (M = 22.1, SD = 1.8) who competed in 18 different team and individual sports. Anthropometric measurements (height, weight, BMI, percent body fat, waist- hip ratio) were taken, as well as motor performance tests (grip strength - GS, back strength - BS, 7 level sit-up - SU7, 10m sprint - S10, 30m sprint - S30, sit and reach - SR, trunk extensiontest - TE, SEMO agility test - SEMO, vertical jump - VJ, standing long jump - An anthropometric and performance disparity between sports mirrored the needs and requirements of the sports, according to descriptive analysis. Height, weight, BMI, percent body fat, and waist-hip ratio all correlated positively or adversely to various components of motor performance, according to multivariate analysis of covariance (MANCOVA) and multiple regression analysis.

Filipe Clemente, Micael Couceiro, Rben Rocha, and Rui Mendes (2011) Heart rate variability is linked to increased parasympathetic activity in archery, and a better balance of parasympathetic and sympathetic activity is helpful to

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performance in the sport. The goal of this study was to evaluate heart rate and archery accuracy in experienced and beginner archers in order to see if experience leads to higher accuracy and lower heart rate. A total of eighteen men (23.2 5.3 years old) took part in the study. The task required the execution of archery with the goal of achieving higher points equating to greater target accuracy. Each participant completed twelve trials in two blocks (for a total of twenty-four trials). We recorded the heart rate immediately before each archery try, as well as the precision of the archery performance. The t- independent test revealed significant statistical differences between experienced and inexperienced archers in heart rate (t(430) = - 4.135, p-value = 0.001) and archery performance score (t(430) = 2.745, p-value = 0.006). In comparison to inexperienced archers, experienced archers have higher accuracy and a lower heart rate. It's probable that the archers' experience will aid in improving arousal control and, as a result, the balance between sympathetic and parasympathetic systems.

3. OBJECTIVES

- To study Effect of heart rate on shooting performance in selected archers.
- To analyze Anthropometric Profile of selected Archers.

4. RESEARCH METHODOLOGY

- **Ethics:**

The study was done at the indoor archery hall, according to the Institutional Ethical Committee. Slow motion analysis was performed using Kinovea association's free motion analysis software (version 0.8.15; Paris, France), and time points frames were selected based on the arrow's release. Every second for 05 seconds before the arrow was released; every second for 05 seconds after the arrow was released, for a total of 11 time points labelled -5 s, -4 s, -3 s, -2 s, - 1 s, 0 s, +1 s, +2 s, +3 s, +4 s, and +5 s, respectively.

Statistical Analysis:

To test the normality of continuous variables and the homogeneity of variances, the Kolmogorov Smirnov test and Levene's test were used. The differences in mean heart rate values at all 11 time points, as well as archery scores 8, 9, and 10, were tested using a one-way ANOVA. Because the mean heart rates at time points +2 s and +3 s were not normally distributed, the Kruskal-Wallis test was employed to compare them between three different scores.

- **Study Design:**

We used a cross sectional observational study design among volunteered elite archers who had participated in International Archery Tournaments as part of the National Team or were selected by the Indian Archery Federation to measure heart rate during shooting and the correlation of shooting performance in Indian archers.

- **Materials:**

The Sports Institute's male elite archers (04 compound archers and 03 recurve archers) volunteered for the study. Their average age was 23.88 3 years, and they had an average of 8.46 2.35 years of sports experience. Table 1 shows the participants' basic anthropometric and athletic profiles. All of the individuals were engaged in active sports training and were free of any illnesses or medications at the time of the study. All of the participants were in the early stages of sports training and performed in front of no audience or coaching staff, with the study's findings having no bearing on their athletic careers. Before the trial, all of the volunteers were told not to ingest any foods or beverages such as tea, coffee, or energy drinks. They were also told not to engage in strenuous physical activity the day before the study and to get at least 8 hours of sleep the night before. Participants used personal archery equipment that they had previously used for sports training.

- **Analytical Statistics:**

To test the normality of continuous variables and the homogeneity of variances, the Kolmogorov Smirnov test and Levene's test were utilised. The differences in mean heart rate values at all 11 time points, as well as archery scores 8, 9, and 10, were tested using a one-way ANOVA. Because the mean heart rates at time points +2 s and +3 s were not normally distributed, the Kruskal-Wallis test was employed to compare them between three different scores.

Profile	Archery Event		All Archers
	Compound (N = 5)	Recurve (N = 4)	(N = 9)
Age, y	24.7 ± 3.65	22.9 ± 2.06	23.9 ± 3.01
Experience, y	7.2 ± 1.51	10.2 ± 2.30	8.5 ± 2.34
Height cm	166.0 ± 4.01	172.0 ± 7.01	168.0 ± 6.01
Body mass, kg	68.0 ± 4.01	70.0 ± 10.01	69.0 ± 6.01
Body mass index, kg/m)	24.8 ± 1.21	23.7 ± 1.40	24.3 ± 1.32
Body fat, %	12.4 ± 1.40	11.0 ± 1.91	11.9 ± 1.7
Lean body mass, %	87.4 ± 1.41	89.0 ± 1.91	88.1 ± 1.7
Waist-to-hip ratio	0.89 ± .01	0.86 ± .04	0.88 ± 0.03

Table 1 Anthropometric Profile of Elite Archers[a]

[a]Values are expressed as mean ± SD.

5. RESULT AND DISCUSSION

Elite compound and recurve archers participated in this study. Based on the archery event, there was no significant difference in the anthropometric and sports profile of archers (P > 0.05). Because they were all elite archers, the lowest score was 8, which was only recorded 07 times out of a total of 210 arrows shot. Score 9 was recorded 86 times, with score 10 being the highest, 117 out of 210 arrows thrown. When comparing the archery scores of 8, 9, and 10, the mean heart rate of all 11 time points was highest for score 8, followed by 9 and 10. At each of the 11 time points, the mean heart rate changed by 1 beat per minute between scores 9 and 10. During shooting, the mean heart rate values for each score. As indicated in Table 2, the mean values of heart rates for at least two archery scores showed a statistically significant difference between score 8 and 9 as well as score 8 and 10, but no significant difference between heart rates for score 9 and 10. The Wilks Lambda 2 = 0.195, F (10, 200) = 82.64, P<0.0001, effect size 2 = 0.805, repeated measures ANOVA used to test the change in heart rate values at the 11 time points with respect to the arrow release showed significant time effect, i.e. heart rate changes significantly at -5 s to +1 s time release of arrow [Wilks Lambda 2 = 0.195, F (10, 200) = 82.64, Further pair wise comparisons revealed that mean heart rates decreased significantly from -5 to + 1 s (P< 0.0001), then climbed to +5 s, which was not statistically significant.

Arrow Release Time, s	Archery Scores		Mean Difference in Heart Rates (95% CI) (I - J)	P Value
	(I)	(J)		
-5	8	9	8.4 (0.86, 16.22)	0.024
		10	7.4 (-0.24, 14.96)	0.061
	9	10	-1.2 (-3.95, 1.60)	0.576
-4	8	9	8.5 (0.98, 16.08)	0.022
		10	7.5 (0.05, 15.00)	0.048
	9	10	-1.0 (-3.74, 1.72)	0.657
-3	8	9	8.2 (0.79, 15.70)	0.026
		10	7.4 (0.06, 14.82)	0.048
	9	10	-0.8 (-3.50, 1.89)	0.760
-2	8	9	8.5 (1.03, 15.86)	0.021
		10	7.8 (0.41, 15.10)	0.035
	9	10	-0.7 (-3.37, 1.99)	0.815
-1	8	9	8.4 (0.81, 15.80)	0.025
		10	7.6 (0.17, 15.02)	0.044
	9	10	-0.7 (-3.42, 2.00)	0.811

Table 2 Score-Wise Mean Heart Rate Values During Shooting- Post Hoc Analysis

6. CONCLUSION

The goal of this study was to use a single variable to observe this complex relationship of adaptive training response. The coach's assessment of the heart rate deceleration pattern in the field has practical applications in performance enhancement. The pattern of heart rate values during the shooting process provides insight into the athlete's adaptive mechanism established over years of physical and psychological training. A field research like this can help athletes, coaches, and sports scientists get real-time feedback. Several studies on archers have shown that repetitive shooting, particularly during competition, puts a significant amount of stress on the cardiovascular system. This study only includes top Indian archers, validating a previously recognized pattern of heart rate values in expert archers and providing a roadmap for future performance-enhancing research in this sector.

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